Climalux Increased Efficiency LED Winter Trial 2024/2025

Interim report

Client: Climalux

Executor: HortiTech BV

Period: 2024

Version: 1.0

Horti Tech
BRAINWARE FOR GREENHOUSES

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Climalux Winter Trial 2024/2025 Increased efficiency of LED lighting

HortiTech BV has carried out the winter trial with the tomato variety Marinice on rock wool.

Sowing date:	30-08-2024
Propagation to:	01-11-2024 (2-header)
Start trial at HT:	01-11-2024

1. Trial design

The test tested the Climalux lamp CLX-2-B1W (B5/G5/R90; 2625 µmol/lamp 140°). The lamps are equipped with a built-in fan that ensures vertical air circulation in the greenhouse. This system not only effectively cools the LEDs, but also moves the air about four times per hour (greenhouse air volume 1,300 m^3).
In the trial period until the end of December, the maximum fan speed was limited to 75%.
Climalux wants to test the lamp's energy-saving and humidity-regulating capacity in the winter period 2024/2025.
For comparison, a standard LED lamp with an identical colour spectrum is installed in a second compartment.
The test takes place in compartment 204 (Climalux) and in compartment 203 (reference).
Both compartments are equipped with the same technology and have a size of 207 m^2.
With the climate settings, watering and planting work, an identical crop is aimed for in both compartment.
The plant measurements start in week 46 and are carried out weekly.
Leaf samples are taken to gain insight into the nutrient uptake.

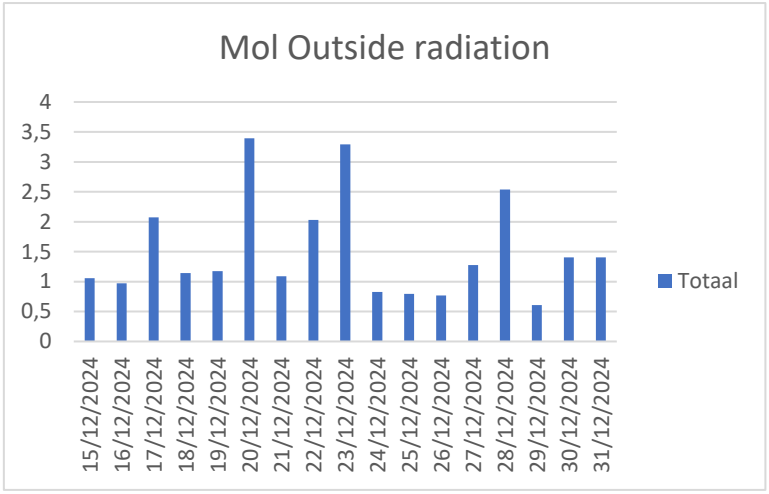
Research questions

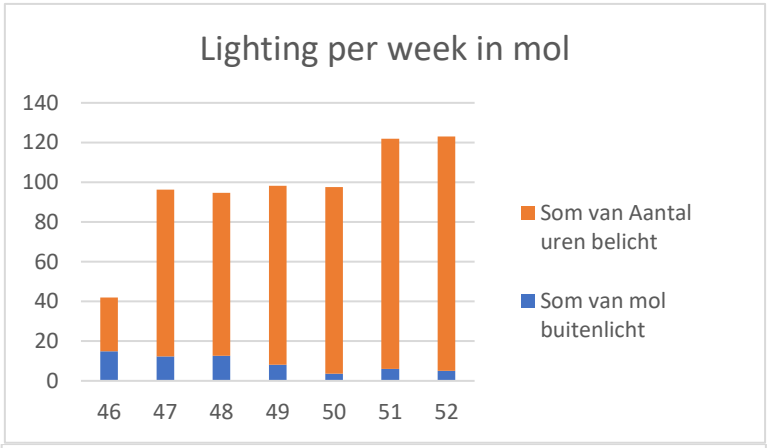
1. Can the Climalux system have a positive influence on the greenhouse climate by reducing the humidity in the greenhouse?
2. Can the Climalux system have a positive influence on the growth and health of the plant (less mould formation, no difference in quality and/or quality improvement, active growth)?
3. Can the Climalux system reduce the energy consumption of the greenhouse?

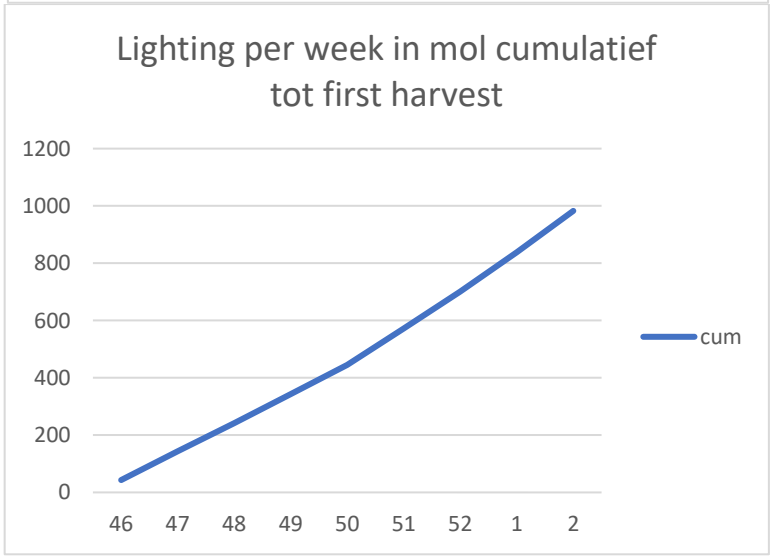
2. Results

Artificial lighting

Over the period from 15 to 31 December 2024, no more than 3 moles of outside light were recorded daily by the Meteo measuring station. 50% of the outside light is included in the test because of the low position of the sun.

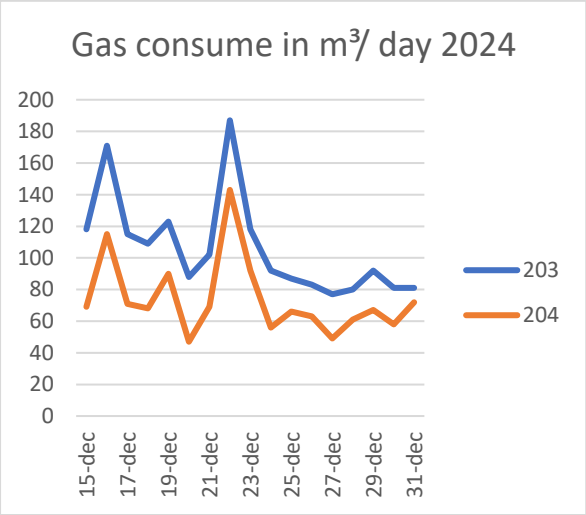


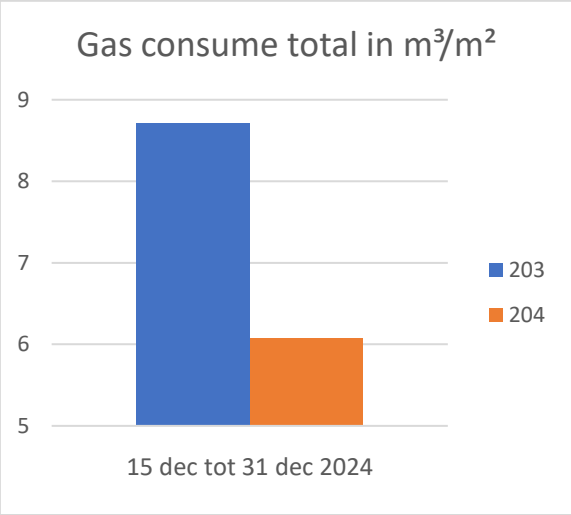




Heat

Due to the improved distribution of humidity in the Climalux compartment, less ventilation was needed and a lower heat input was required. This resulted in more efficient energy consumption. In the period 15 December '24 to 31 December '24, 30.4% less gas was consumed in section 204 than in the reference section.

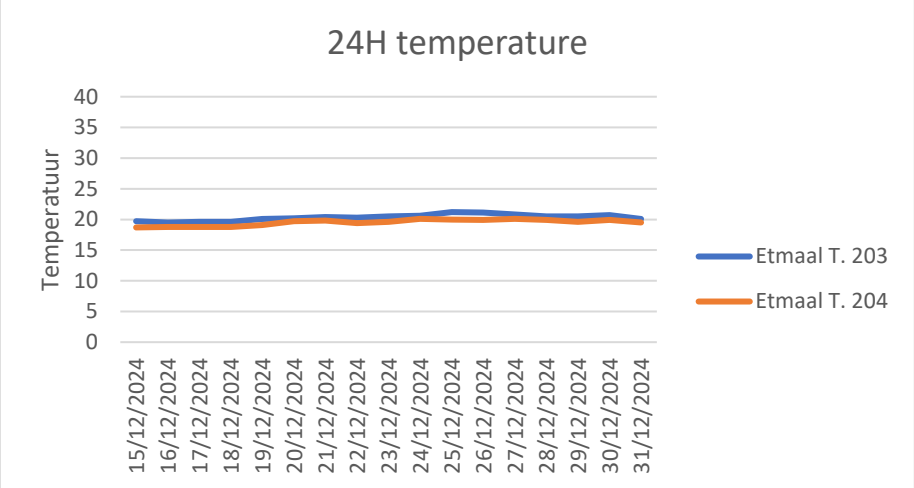




In both compartment, a growth tube of 35C was used.
In the reference, an undernet temperature of +5C has been applied for comparable growth.

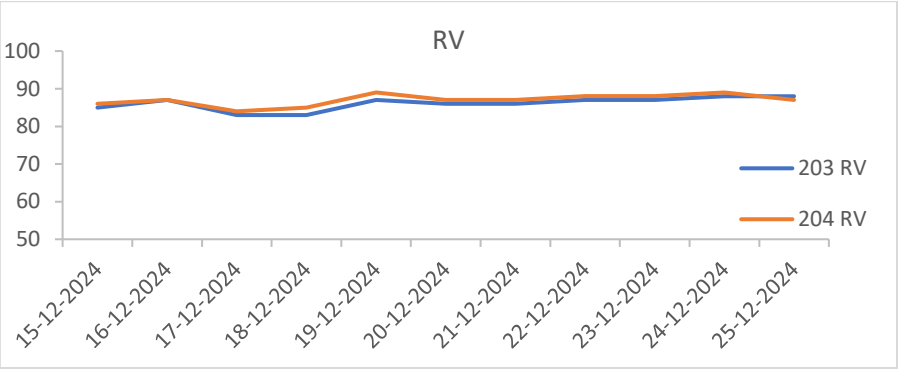
Daily temperature

The aim is to maintain the same daily temperature in both greenhouse components.



Greenhouse climate

The Climalux lamp has achieved the same greenhouse climate with adjusted control parameters. The average RH in the province 204 was comparable to the reference.



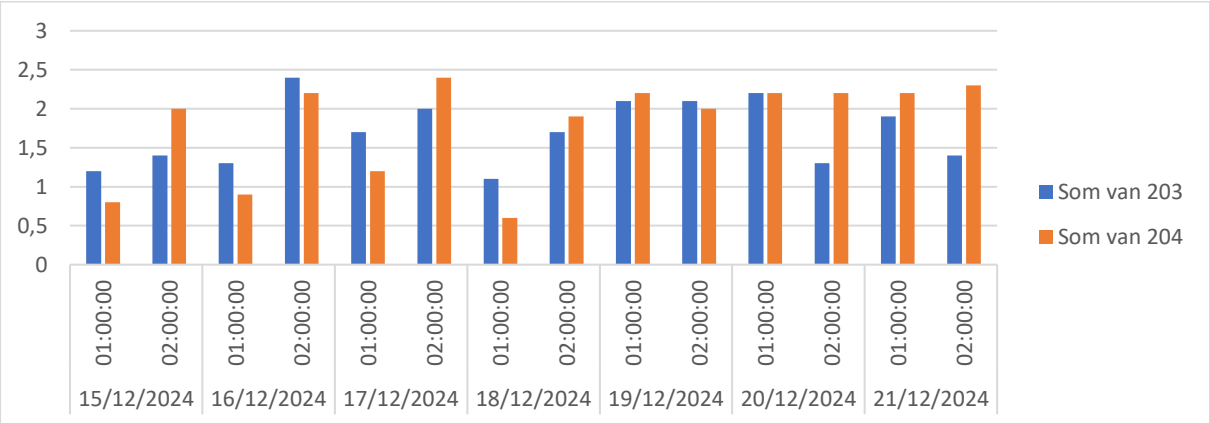
The graph of RH at different height levels shows that the air circulation through all levels of the greenhouse increases and decreases at the same time.
Vertical RH measurements were measured in the Climalux compartment:

RH at head height	81,4 %
RH in the middle of the crop	74,6 %
RV Mat Height	83,0%

In combination with the smoke trial, Horti-Tech concludes improved air mixing at all levels in the greenhouse.

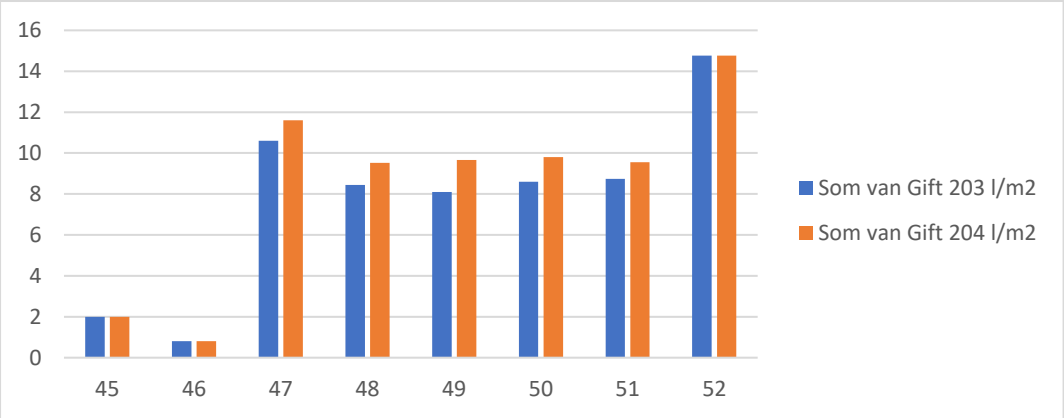
VD Difference Snapshot

The lighting regime of greenhouse compartments 203 and 204 was set to ON at 1:15 in December. The snapshot in the graph below shows that dehumidification at Climalux in greenhouse compartment 204 is much faster compared to greenhouse compartment 203.



Evaporation (water absorption)

The evaporation of the plants in the two sections was different. In greenhouse compartment 204, an increased water intake was recorded; Between weeks 45 and 52, 5.7 litres/m² more were given. The drain in both sections was similar.



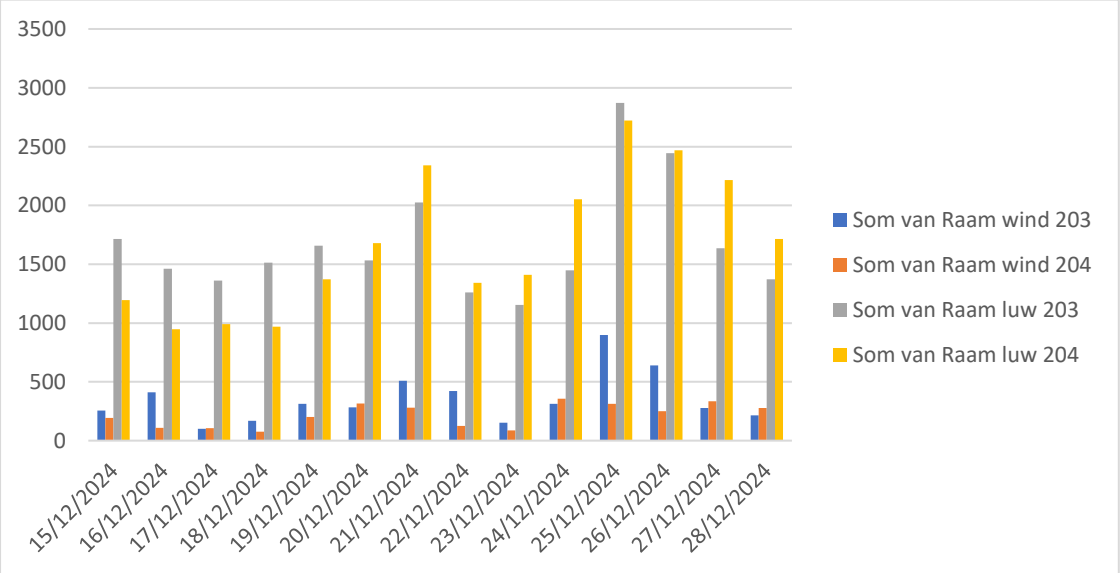
Screen cloth

There are energy and blackout screens in the compartments. The settings were the same in the first five weeks.

The gap controls were smaller in the Climalux compartment.

Window position

The window positions of greenhouse compartment 204 with Climalux were able to be more limited than in the reference greenhouse. In particular, the wind side of greenhouse compartment 204 with Climalux was able to remain closed more often. The graph adds up the window position percentages per quarter of an hour per day. The added wind side percentages are 60% lower in greenhouse compartment 204 with Climalux.



Sum of Window position wind 203	Sum of Window position wind 204	Sum of Window position luw 203	Sum of Window position luw 204
4960	3025	23448	23423

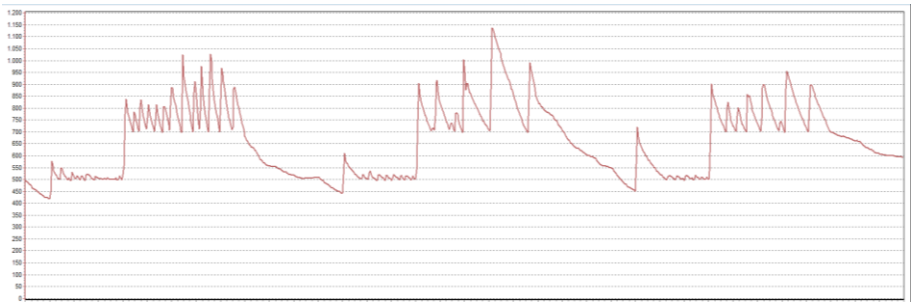
Watering and nutrients

The vertical airflow along the heads of the plants resulted in a 10% higher water uptake in 204 compared to a standard crop.
The water and nutrient uptake in 204 was fairly easy, so no extra pipe was needed.
In the comparative section 203, a tube was used to get the airflow going and the excess heat had to be removed (venting). This action created a less pleasant climate in 203.

The first leaf analyses show that the nutrient intake in the Climalux compartment was higher than in the reference. However, it is still too early to demonstrate a course of the nutrient analyses.

CO2

The CO2 dose in both compartments was the same. In the December period, a respective CO2 concentration of 700 ppm during the day and 500 ppm at night was chosen.



Crop development and plant health

Under the Climalux lamp, a fuller crop has emerged; The plants have a larger plant mass. This has not led to smaller fruits (which was originally expected).
In week 50, an extra head was maintained and the planting density was increased from 2.5 heads/m² to 3.25 heads.
In week 52, the first trusses started to colour.
The plant measurements show that 0.2 more trusses have been set under the Climalux lamp until the end of December 2024.
Under the Climalux lamp, a clearly better plant position was observed.

3. Preliminary conclusion until the end of December 2024

In the first months of cultivation, clear differences were observed and the Climalux lamp showed that significant energy savings have been achieved.
The trials show a saving of 30.3% percent compared to the reference.
HortiTech expects that energy savings of 35% will be possible if these techniques are further developed.

In addition to the energy savings, a higher intake of water and nutrients has been observed. This uptake affected the growth of the plants.
The plants in the Climalux compartment are stronger, fuller and more powerful than in the reference.

The Climalux lamp requires an adapted cultivation strategy in a positive sense compared to conventional crops today. All humidity controls in the climate computer seem to need to be used less. Plant uptake (water and nutrients) becomes an important control parameter.

The screen strategy requires a different approach; such as less ventilation and less tube/growth tube use. That can be investigated further in the future.

LED is known to have lower plant temperatures due to the lack of radiant heat.
The influence of the Climalux lamp, in which the convection heat that is not used with reference LED is now used, has a positive effect on the plant temperature and evaporation. This applies not only to the crop at the top, but also at different heights within the crop. This positive effect needs to be further investigated. The question that arises here is whether the use of convection heat can compensate for the loss of infrared radiation from the Son-T lamp.

The influence of fan strength becomes a new control parameter and can be investigated.